Food Consumption and Greenhouse Gas Emissions: Calculations for Localize Website

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Introduction

To support King County's Localize website, we have produced estimates of the greenhouse gas (GHG) emissions associated with different hypothetical diets. This memo outlines our methodology and results.

Methodology

We developed estimates of the GHG emissions associated with different diets using the following method:

1. **Characterize different diets.** To estimate the composition of the omnivorous, vegetarian, and vegan diets, we started with data from the USDA on the average U.S. diet (USDA 2011). We considered the average U.S. diet to be "omnivorous" and used USDA data to estimate calories consumed in each food group (e.g., fruits, vegetables, red meat). We then estimated the composition of a vegetarian diet by adjusting the omnivorous diet based on a national survey of vegetarians and omnivores (Haddad and Tanzman 2003). For example, the survey found that vegetarians consumed 0% as much meat, 92% as much milk, and 127% as many vegetables as omnivores, and we adjusted the average national diet (USDA 2011) accordingly. To approximate a vegan diet, we assumed that vegans ate no meat, dairy, or other animal products, and we redistributed the calories to other food groups in the same proportion as how calories from vegetarians not eating meat were redistributed to other food groups.[1]
2. **Develop estimates of GHGs per calorie for several different food groups,** using SEI's CBEI input-output model and data from the USDA. More specifically, we used national GHG intensities (CO2e/$) from CBEI (Stanton et al. 2011) coupled with estimates of national expenditures (MIG Inc. 2009) to estimate national GHGs associated with food consumption. We then divided these estimates by data on food consumption in calories (USDA 2011) to develop estimates of the GHGs per calorie for each food type.[2]
3. **Adjust the diets by age and gender**, using USDA data on recommended calorie intakes by age and gender (USDA and USDHHS 2010). We assumed that the "average" U.S. resident was a 36-year old male or a 38-year-old female (per the U.S. census). Starting with the actual average U.S. calorie consumption (USDA 2011), we developed estimated diets by age and gender by scaling calorie intakes according to the USDA recommendations.[3]
4. **Calculate the GHGs associated with each diet** by multiplying calories times GHGs per calorie.

Results

Overall, the process above yielded an estimate that vegetarian diets are associated with approximately 31% fewer GHG emissions than the average U.S. "omnivore" diet, with a vegan diet being associated with 40% fewer GHG emissions. Detailed results by gender, age, and diet type are presented in Table 1 for use in the Localize calculator.

[1] The result of this process involved two different types of shifts: a shift in the types of foods consumed (e.g., the shift from meat to plant-based foods), but also a reduction in calories for both vegetarians (reduced 19%) and vegans (reduced 23%).

[2] Matching up the categories from CBEI to those reported by the USDA was a significant process that could benefit from further research. Note also that our estimates of GHGs per calorie did not include the direct or indirect land-use benefits of switching from land-intensive meat to less land-intensive plant-based foods. Reducing pressures on land could both avoid deforestation and create new opportunities to use land for other purposes (e.g., reforestation and carbon sequestration).

[3] This process assumes that the *rate* of increase or decrease in actual calorie consumption across ages and genders follows the USDA recommendations, which may not be the case. However, we were not aware of another way to characterize diets by age and gender, and the Seattle / King County department of Public Health recommended the USDA data we used (USDA and USDHHS 2010)

Table 1. Estimated Annual Carbon Footprint (metric tons CO_2e) By Gender, Age, and Diet

Age	Male			Female		
	Omnivore	Vegetarian	Vegan	Omnivore	Vegetarian	Vegan
2	1.3	0.9	0.8	1.3	0.9	0.8
3	1.8	1.3	1.1	1.6	1.1	0.9
4	1.8	1.3	1.1	1.8	1.3	1.1
5	1.8	1.3	1.1	1.8	1.3	1.1
6	2.1	1.4	1.3	1.8	1.3	1.1
7	2.1	1.4	1.3	2.1	1.4	1.3
8	2.1	1.4	1.3	2.1	1.4	1.3
9	2.4	1.6	1.4	2.1	1.4	1.3
10	2.4	1.6	1.4	2.4	1.6	1.4
11	2.6	1.8	1.6	2.4	1.6	1.4
12	2.9	2.0	1.7	2.6	1.8	1.6
13	2.9	2.0	1.7	2.6	1.8	1.6
14	3.1	2.2	1.9	2.6	1.8	1.6
15	3.4	2.3	2.0	2.6	1.8	1.6
16	3.7	2.5	2.2	2.6	1.8	1.6
17	3.7	2.5	2.2	2.6	1.8	1.6
18	3.7	2.5	2.2	2.6	1.8	1.6
19–20	3.7	2.5	2.2	2.9	2.0	1.7
21–25	3.7	2.5	2.2	2.9	2.0	1.7
26–30	3.4	2.3	2.0	2.6	1.8	1.6
31–35	3.4	2.3	2.0	2.6	1.8	1.6
36–40	3.4	2.3	2.0	2.6	1.8	1.6
41–45	3.4	2.3	2.0	2.6	1.8	1.6
46–50	3.1	2.2	1.9	2.6	1.8	1.6
51–55	3.1	2.2	1.9	2.4	1.6	1.4
56–60	3.1	2.2	1.9	2.4	1.6	1.4
61–65	3.1	2.2	1.9	2.4	1.6	1.4
66–70	2.9	2.0	1.7	2.4	1.6	1.4
71–75	2.9	2.0	1.7	2.4	1.6	1.4
76+	2.9	2.0	1.7	2.4	1.6	1.4

Sources Cited

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